Vinson & Elkins
ATTORNEYS AT LAW

VINSON & ELKINS L.L.P.
THE WILLARD OFFICE BUILDING
1455 PENNSYLVANIA AVE., N.W.
WASHINGTON, D.C. 20004-1008
TELEPHONE (202) 639-6500
FAX (202) 639-6604

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WRITER'S TELEPHONE

(202) 639-6755

July 18, 1997

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

Mr. William F. Caton
Acting Secretary
Federal Communications Commission
1919 M Street, N.W., Room 222
Washington, DC 20554

Re: IB Docket No. 96-220
Notice of Ex Parte Presentation

Dear Mr. Caton:

Leo One USA Corporation ("Leo One USA"), by its attorneys, hereby notifies the Commission, pursuant to Section 1.1206 of the Commission's rules, of a meeting with David Siddall of the office of Commissioner Ness on July 16, 1997. The purpose of the meeting was to discuss the 1997 World Radiocommunications Conference as it relates to Little LEOs, as well as the issues in the pending Little LEO proceeding. An original and one copy of this notice are being submitted to the Secretary's Office. A copy of this letter is being provided to Mr. Siddall.

Any questions regarding this matter should be directed to the undersigned.

Respectfully submitted,

Robert A. Mazer

Robert A. Mazer
Counsel for Leo One USA Corporation

cc: David Siddall

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Co-frequency Sharing Between the Land Mobile Service and Non-GSO MSS Below 1 GHz (Earth-to-Space), Background and Potential US Allocation Proposal

PRESENTATION TO THE FCC - WIRELESS AND INTERNATIONAL BUREAUS

by Representatives of Leo One USA

July 17, 1997

Tom Rudd
Erik Goldman
Ed Miller
Mark Lewellen
Bob Mazer

1. Introduction

- WRC-95 recognized the need for additional frequency allocations for non-GSO MSS below 1 GHz and (in Resolution 214) called for urgently needed sharing studies with services having existing allocations.

- Application of advanced technologies in MSS networks allows innovative methods of frequency sharing between services.

- Baseline studies were performed and submitted to ITU-R Working Party 8D, the WRC-97 Advisory Committee - IWG 2A, CPM-97, and CITEL PCC.III. (Annex 1 - List of technical papers.)

- The range of equipment types and the varying operational uses in LMS networks, coupled with variations in proposed non-GSO MSS networks and equipment create hundreds of different sharing scenarios. The baseline analyses and simulations may be extended and applied to other cases.

2. General conclusions based on sharing studies (from CPM-97 Report and CITEL PCC.III Meeting) (Annex 2)

- Co-frequency sharing can be accomplished with narrow-band, frequency-agile, MSS uplinks.
- Short sub-second packets, low duty cycle, frequency agility, dynamic channel assignment technique, and avoidance of LMS occupied channels reduce the potential for interference and facilitate sharing with the LMS.
- Mean times between interference events at an LMS receiver ranged from 10 hours to 21 months for the systems modeled and for the type of land mobile user studied.
- Simulations showed that a sufficient number (6) of clear channels (temporarily unused by LMS systems) can be found for MSS uplinks.
- Specific cases requiring additional study were identified by CPM-97. Some of these were analyzed with the result that the modeled interference was less than 0.1% of the time.

3. Sharing Studies and Sharing Criteria

- Sharing criteria - set by affected service
  - Threshold values
  - C/I, C/(I+N)
  - Level
  - Duration
  - Duty Cycle
  - Decrease in Availability

- LMS has not established sharing criteria

- WP 8A/TEMP/35 indicated:
  - Critical systems
    - Designed for 99% availability, 1% unavailability
    - Increasing unavailability by 10%, or decreasing availability to 98.9% is considered acceptable.

- Acceptable degradation for non-critical systems not indicated.
  (Might 90% availability decreased to 89% be acceptable?)

- Analyses conducted support availability degradation due to MSS operation of 99% availability reduced to no lower than 98.9%.

- Some users of LMS networks maintain that no additional interference can be accepted.

4. Additional Analyses (Annex 3)

- Band-scanning receiver can detect 23 ms duration transmission at LMS transmitter power of 30 mW, with 99.9% detection probability.

- For repeater operation, the interference statistics at an individual receiver remain as modeled in the baseline analyses. However, each interference event affects a number of receivers.

5. Draft Proposal for MSS/LMS Sharing in the 450-470 MHz band (Annex 4)

- MOBILE-SATELLITE (Earth-to-space) primary allocation in the band 450-470 MHz
- MOD of footnote **S5.209** to indicate 450-470 MHz used by MSS is limited to non-geostationary satellite systems.
- MOD of footnote **S5.271A** to indicate use of band 450-470 MHz is subject to co-ordination under No. **S9.11bis.**

6. Comments and Discussion on Draft Proposal (Annex 5)

- MSS/LMS Interactions

WP 8D preparations	March & Oct. 1996
IWG-2A of WAC-97	thru Sept. 1996
CPM-97 preparations	April 97
CITEL PCC.III preparations	June 1997

- Points raised by LMS interests that had been answered in previous discussions were still brought up in June 16 Comments on Draft Proposal

- Major LMS points from June 16 Comments, and Replies by Leo One
  - AAR Affiliated American Railroads
  - ITA Industrial Telecommunications Association

- ITA and AAR maintain that sharing has not been demonstrated.
Reply: Analyses have been supplied in national and international meetings. Conclusions reached support analytical demonstration of MSS and LMS sharing.

- AAR, ITA, and Motorola identify LMS system features not taken into account in the baseline analysis.
Reply: Leo One has extended the application of the baseline analyses to additional cases. However, it is not possible nor is it required that all sharing scenarios be fully examined before additional allocations are made to the MSS.

- ITA and AAR expect zero interference if frequencies are shared with MSS.
Reply: Sharing inevitably causes some interference. Sharing criteria determine acceptability of interference. For railroad communications, 2 times 68.75 kHz of bandwidth could be avoided in the US.

- Motorola notes that, "A conservative estimate is that 10 per cent of the radios operating in the 450 MHz band are not licensed."
Reply: One wonders how the land mobile community can deal with the potential interference and the 10% loss of spectrum capacity caused by about 500,000 illegally unlicensed radios, and is yet concerned about the potential interference effects of a MSS network that would use only 0.04% of the channel capacity. (A single non-GSO MSS network co-frequency sharing with the LMS in 20 MHz of bandwidth would use less than 0.04% of the channel capacity available to terrestrial systems within the satellite beam.)
6 channels /(20 MHz÷25 kHz/channel x 20 times frequency reuse) = 6/16000 = 0.04%

- AAR and ITA maintain that the CPM-97 Report requires additional studies to demonstrate the feasibility of MSS and LMS co-frequency sharing.
Reply: The additional studies identified in the CPM-97 Report are to examine some specific cases among the plethora of sharing scenarios that exist between MSS and LMS systems. "Feasible" is used in the CPM-97 Report <u>only</u> to indicate that it <u>is feasible</u> for MSS and LMS to share, and that sharing <u>may be feasible</u> in other bands below 1 GHz.

7. Requested Actions/Strategy

- FCC support for 450-470 MHz, international primary allocation to MSS (Earth-to-space)

- Contiguous 20 MHz for international allocation improves sharing and provides flexibility for non-GSO MSS systems to use in different Regions/areas the frequencies best suited for sharing, taking account of the regional use by LMS.

- Starting with 450-470 MHz as the proposed allocation allows for a US final position with selected segments peculiar to Regions/administrations.

- US domestic allocations/use after WRC-97 can account for situations such as avoiding the frequencies given to prime use by railroads.

July 17, 1997

Co-frequency Sharing Between Non-GSO MSS below 1 GHz and LMS Systems

Comments and Discussion

by Leo One USA

1. Introduction

In response to Resolution 214 (WRC-95), urgently required studies were performed "on operational and technical means to facilitate sharing between the non-GSO/MSS and other radiocommunications services having allocations and operating below 1 GHz." Analyses and simulations of co-frequency sharing between non-GSO MSS networks and land mobile service networks were performed and submitted to ITU-R Working Party 8D. The methodologies used were as described in Doc. 8D/TEMP/133 Annex 1, and the analyses were performed at 149 and 460 MHz. The specific sharing scenario examined and the example results of the application of the methodology are contained in Appendix A to Annex 1 of Doc. 8D/TEMP/133. In this analysis, a single non-GSO MSS network was modeled with the following major characteristics: 48 satellites in 8 orbital planes in 950 km altitude circular orbits; narrow-band frequency division multiplexing for the Earth-to-space transmissions; operation in a store-and-forward mode; transmissions within 500 ms frames containing digital packets; satellite use of a band scanning receiver to implement a dynamic channel activity assignment system that assigns unused channels to earth stations for uplink transmissions; and uplink data rates of 2.4, 4.8, and 9.6 kbits/s. The land mobile station was modeled with the following characteristics: an analogue, frequency modulation system (or digitally modulated, binary-FSK system); a vertically polarized antenna having 0 dBi gain towards the satellite; 10 meter antenna height product (consistent with Recommendation ITU-R M.1039-1); minimum received signal power assumed to be -140 dBW; and channel bandwidths of 6.25, 12.5 and 25.0 kHz. The analysis assumed multiple worst-case conditions: 1) non-GSO MSS MESs transmitting at 100% of capacity, 24 hours per day, 2) terrestrial stations and non-GSO MSS MESs geographically clustered in the same areas, and 3) dynamic channel avoidance <u>not</u> employed. The results of these analyses have been incorporated into the CPM Report, sections 4.1.1.1.1 through 4.1.1.2.1. It must be noted that the baseline analyses and simulations of potential interference into LMS receivers were performed for the <u>infrequent</u> cases where the band-scanning receiver does not detect an active LMS channel. In all other cases, there is no interference to the LMS receivers.

The detailed analysis submitted to ITU-R Working Party 8D and described in the previous paragraph is a baseline analysis that represents only one sharing scenario of the many possible sharing situations. There are many different types of land mobile equipment with differing characteristics, and the systems are operated in many different ways. Additionally, the non-GSO MSS networks and equipment are not totally homogeneous. Thus there are literally hundreds of different sharing scenarios that might be encountered in practice. To evaluate the sharing possibilities in other scenarios, the baseline analysis may be extended and applied to those cases. Later in this paper, the results of the baseline analysis are modified to apply to other sharing cases that have been identified as requiring further study.

2. General Conclusions Based on Prior Sharing Studies

A list of technical papers supporting additional allocations for non-GSO MSS below 1 GHz is given in Annex 1. Based upon these analyses and other international input papers on MSS/LMS sharing, the text in Annex 2 (from CITEL PCC.III Working Group on WRC-97) represents in synopsized form the conclusions reached and supported by administrations at the CPM-97 and adds the further conclusions supported by administrations at the last CITEL PCC.III meeting.

In summary, sharing between non-GSO MSS and terrestrial fixed and mobile systems in the uplink direction can be accomplished by designing the MSS systems to operate in a narrow-band, frequency-agile fashion. Also, short, sub-second data bursts and low duty-cycle transmissions are other applicable interference reduction techniques. Analyses had shown that mean times between interference events at a LMS receiver ranged from 10 hours to 21 months for the systems modeled and for the type of land mobile user studied. Also, a sufficient number of clear channels (temporarily unused by LMS systems) can be found for MSS uplinks. Specific cases requiring additional study were identified, and additional analyses were provided for some of these, with the result that the modeled interference was less than 0.1 per cent of the time.

3. Sharing Studies and Sharing Criteria

Res. 214 (WRC-95) called for "urgently required" sharing studies. The prior section of this paper indicated that sharing studies had been performed and had been considered and reviewed by the ITU-R. The studies quantified the interference and identified "operational and technical means to facilitate sharing between the non-GSO/MSS and other radiocommunications services," as requested by Resolution 214.
Generally, in sharing studies, the affected service establishes sharing criteria that determine the allowable interference. Elements of sharing criteria include:

- Threshold values
- C/I, C/(I+N)
- Level
- Duration
- Duty cycle
- Decrease in availability

The LMS has not yet established sharing criteria. The studies performed used a threshold level of C/(I+N) equal to 10.7 dB to define the periods of interference. In addition to the level of interference, the duration and the duty cycle also determine the effect on the service experiencing the interference. Those parameters have not yet been agreed upon by the land mobile service. The analyses performed used sub-second data bursts and a duty cycle of 1% or less for the MSS uplink transmissions. The net effect of interference from non-GSO MSS operations may be a small decrease in the channel availability to the affected LMS users. In document WP 8A/TEMP/35 it is noted that, "Critical terrestrial systems for public safety use agencies, utilities and petroleum companies are often designed for 99% availability over the intended service area (i.e., 1% unavailability). For such systems, increasing the unavailability by 10% would reduce system availability to 98.9%. This is considered acceptable degradation." The implication here is that other, less critical systems are designed for lower availability and could accept a correspondingly larger degradation in availability. However, some users of LMS networks maintain that no additional interference can be accepted.

For the sharing criteria used in the studies, the analyses conducted support co-frequency sharing between LMS systems and non-GSO MSS networks with an availability degradation of no more than 0.1%, i.e., availability reduced from 99% to no lower than 98.9%, which value is "considered acceptable degradation" for "critical terrestrial systems" by WP 8A.

4. Additional Analyses

Annex 3 presents analyses of some of the sharing cases that were identified in the CPM-97 Report and in the Working Party 8A Liaison Statement (Doc. 8A/TEMP/35) as requiring further study. Included are analyses of: sensitivity of MSS band-scanning receivers to short duration LMS transmissions, deviations from worst case assumptions used in modeling, use of repeaters in LMS networks, and LMS channels with varying traffic loading rates. These analyses further support co-frequency sharing between MSS and LMS networks.

5. Draft Proposal for MSS/LMS Sharing in 450-470 MHz Band

Annex 4 is the Draft proposal (from the WRC-97 Advisory Committee) for additional MSS allocations in the band 450-470 MHz.

6. Comments and Discussion on Draft Proposal.

In preparation for WRC-97 and in response to the call for sharing studies by Resolution 214 (WRC-95), the MSS and LMS communities have had technical interactions and discussions concerning frequency sharing since early 1996. It began with gathering information about the technical and operational characteristics of LMS systems, and concluded with recent discussions about the Draft proposal in Annex 4. The specific history is:

WP 8D preparations	March & Oct. 1996
IWG-2A of WAC-97	thru Sept. 1996
CPM-97 preparations	April 97
CITEL PCC.III preparations	June 1997

Concerns of the LMS community about technical sharing studies were addressed via discussions and written comments. However, points that had been answered in earlier discussions were still brought up in the most recent comments by the LMS community.

Annex 5 is a summary of comments made by LMS interests in response to the FCC invitation for public comments on Recommendation 11 (proposed additional spectrum for Little LEO uplinks in the band 450-470 MHz) from the WRC-97 Advisory Committee. Also provided for the record in Annex 5 are reply comments by Leo One. In Annex 5 and in the following discussion the following abbreviations are used:

AAR	Affiliated American Railroads
ITA	Industrial Telecommunications Association
M	Motorola

Major points from Annex 5 are:

- ITA and AAR maintain that sharing has not been demonstrated.
  Leo One Reply: Analyses have been provided to WP 8D, IWG-2A, and to CITEL PCC.III, and the resultant conclusionary statements are an analytical demonstration of MSS and LMS sharing.
- AAR, ITA, and M several times each identify LMS system features and technical characteristics that were not taken into account in the baseline analyses.
  Leo One Reply: Numerous sharing scenarios exist and Leo One has extended the baseline analyses to include cases with differing technical characteristics. However, it is not possible nor is it required that all sharing scenarios be fully examined before additional allocations are made to the MSS.
- ITA and AAR at several points indicate that their expectations are for zero interference if frequencies were to be shared with the MSS.
  Leo One Reply: Sharing inevitably causes some level of interference (however small), but the criteria for sharing would properly be based upon establishing acceptable levels of interference, rather than upon a criteria of zero interference. {Even the radio astronomers allow an interference threshold level of -255 dB(W/m^2/Hz).} In the particular case of railroad communications where there appears to be given special use and special protection of certain channels (2 times 68.75 kHz of bandwidth in the US), the MSS could provide protection from interference by avoiding the use of those channels in the US. This would most appropriately be done at the time of domestic implementation of the additional MSS allocations, rather than modifying the Draft proposal.
- Motorola notes that, "A conservative estimate is that 10 per cent of the radios operating in the 450 MHz band are not licensed."
  Reply: One wonders how the land mobile community can deal with the potential interference and the 10% loss of spectrum capacity caused by about 500,000 illegally unlicensed radios, and is yet concerned about the potential interference effects of a MSS network that would use only 0.04% of the channel capacity. (A single non-GSO MSS network co-frequency sharing with the LMS in 20 MHz of bandwidth would use less than 0.04% of the channel capacity available to terrestrial systems within the satellite beam.)
  6 channels /(20 MHz÷25 kHz/channel x 20 times frequency reuse) = 6/16000 = 0.04%

- AAR and ITA maintain that the CPM-97 Report requires additional studies to demonstrate the feasibility of MSS and LMS co-frequency sharing.

  Leo One Reply: The additional studies identified in the CPM-97 Report are to examine some specific cases among the plethora of sharing scenarios that exist between MSS and LMS systems. There are only two mentions of 'feasible" or "feasibility" in the CPM-97 Report with regard to MSS and LMS sharing. In one case the sentence begins, "The conclusion reached to date, as a result of an in orbit demonstration test, is that it is feasible for narrow-band uplinks of a single non-GSO MSS using DCAAS to share spectrum with certain land mobile services...." In the other case the sentence begins, "Sharing may be feasible in other bands below 1 GHz...."

7. Requested Actions/Strategy

FCC support for 450-470 MHz, international primary allocation to MSS (Earth-to-space)

20 MHz contiguous for international allocation improve sharing and provides flexibility for non-GSO MSS systems to use in different Regions/areas the frequencies best suited for sharing taking account of the regional use by LMS.

Starting with 450-470 MHz as the proposed allocation allows for a US final position with selected segments peculiar to Regions/administrations.

US domestic allocations/use after WRC-97 can account for situations such as avoiding the frequencies given to prime use by railroads.

Annex 1

July 2, 1997

Documents Supporting
LMS/Non-GSO MSS Co-Frequency Sharing

Doc.	Title	Date
WP8D/TEMP/128	Spectrum Demand for Non-GSO MSS Below 1 GHz Services	11/5/96
IWG-2A/59(Rev.2)	Frequency Sharing Between Non-GSO MSS (Narrowband Earth-to-Space Links) and LMS Systems	10/21/96
Addendum to Doc. IWG-2A/59(Rev.2)	Additional Information on Frequency Sharing Between Non-GSO MSS (Narrowband Earth-to-Space Links) and LMS Systems	2/13/97
IWG-2A/84(Rev.1)	Draft Proposals for Agenda Item 1.9.1	2/13/97
IWG-2A/84/ Addendum 1 (Rev.1)	Proposals for Agenda Item 1.9.1 Mobile-Satellite Services Below 1 GHz	2/13/97
CPM97/52	Co-Channel Frequency Sharing Between Non-GSO MSS (Narrow-Band Earth-to Space Links) and LMS Systems	4/22/97
PCC.III-705/97	Chapter 4.1 Mobile Satellite Service below 1 GHz. Modifications to Section 6.2 "Sharing with the Fixed and Mobile Services"	6/7/97

Annex 2

Conclusions Reached and Supported by Administrations at CPM-97 and at the Last CITEL PCC.III Meeting

Sharing with the Mobile Service

Sharing between non-GSO MSS and terrestrial fixed and mobile systems in the uplink direction can be accomplished by designing the MSS systems to operate in a narrow-band, frequency-agile fashion. MSS systems can also employ wideband, low-power density, spread-spectrum transmissions which will provide sufficient margin against interference to other services. Both of these transmission techniques reduce the probability of interference to fixed and mobile systems. In addition, the nature of the data-only services provided by MSS systems and the markets served by them are amenable to incorporation of other interference reduction techniques such as short, sub-second length data bursts and low-duty cycle transmission. For FDMA mobile earth stations, Recommendation ITU-R M.1039-1 notes that an optimum length of transmission might be up to 500 ms and a time duration of 1% in 1-15 minutes has been suggested for sharing with certain analogue voice services.

A Working Document Towards Draft New Recommendations, "Methods for Modelling Frequency Sharing Between Stations in the Land Mobile Service Below 1 GHz and Non-GSO Mobile Earth Stations" (Document 8D/TEMP/ 133) was noted at the recent meeting of ITU-R WP 8D. This document includes methods for modelling frequency sharing between stations in the LMS and MSS, and a methodology for calculating interference probability from non-GSO mobile earth stations to land mobile stations operating below 1 GHz for the particular characteristics of the terrestrial systems that had been studied. This document is to be studied and evaluated at the next meeting of WP8D

A baseline analysis and simulation of sharing between non-GSO MSS networks and land mobile service networks was performed using one of the methods cited in the previous paragraph. That analysis (Doc. 8D/TEMP/133) was reviewed by Working Party 8D and the conclusions were reflected in the CPM text. For the MSS and LMS networks modelled and for a variety of channelization plans, MES bit rates, and terminal distributions, the mean time between observed interference events for the type of land mobile user studied was found to range from 10 hours to 21 months. The land mobile user would observe the interference event as a single, short-term event. Since in general the non-GSO MSS network will be able to identify active mobile channels, the actual interference from non-GSO MSS MESs into a given land mobile station will be much less than that calculated under the worst-case assumptions used.

This same analysis and simulation also examined the possibility of LMS transmitters causing interference into satellite receivers in MSS networks. Since narrowband non-GSO MSS networks plan to use dynamic channel assignment techniques to avoid channels being actively used by the land mobile stations, this potential interference situation becomes a question of whether the MSS network can find a sufficient number of temporarily unused land mobile channels to support the required Earth-to-space transmissions. The simulations showed that for the conditions studied, in 5 MHz of shared bandwidth, 570,000 and 1.5 million terrestrial mobile stations could operate and still leave a minimum of 6 clear channels for MES uplink transmission, for 25 kHz and 6.25 kHz LMS channelization, respectively. (The 25 kHz channelization is currently widely used, and the 6.25 kHz channelization represents future use of the LMS bands.) [The numbers 570,000 and 1.5 million were calculated as lower bounds on the number of terrestrial mobile stations, under a set of worst case modeling assumptions. Under actual operating conditions, the numbers would be greater than these calculated lower bounds.]

The CPM Report concluded that the results of the analyses and simulations show that frequency sharing between narrow-band, Earth-to-space links for a single non-GSO MSS below 1 GHz network and analogue, frequency modulated (or digitally modulated, binary-FSK) land mobile services, as described, would produce infrequent interference to the land mobile service. The results indicate that sharing, as studied, could allow a single non-GSO MSS network to find a sufficient number of channels to operate in the Earth-to-space direction. The baseline simulation and analysis was performed at 149 and 460 MHz with a specific set of technical characteristics for the land mobile system and for a specific non-GSO MSS network. The CPM report stated that sharing may be feasible in other bands below 1 GHz where the characteristics of the land mobile systems currently in use are similar to those studied by the ITU-R. However, sharing with other types of terrestrial land mobile systems needs further study.

The CPM Report identified several cases with LMS equipment and operational characteristics that are different from those modelled in the baseline analysis and simulation. To cover these cases, it was indicated that further studies were required for land mobile systems which utilize short burst digital acquisition signals, for systems with higher traffic loading rates than those studied, and for land mobile base stations with low loading rates located at high elevation points with high gain antennas. Additionally, a Liaison Statement relevant to the CPM Report was developed by Working Party 8A (Document 8A/TEMP/35) at its last meeting. This document contained information regarding the characteristics of various terrestrial mobile systems operating below 1 GHz and particular "Land mobile interference considerations" that would be relevant to sharing with non-GSO MSS systems.

Application of the baseline analysis and simulation to some of the additional sharing cases cited in the previous paragraph showed that interference to LMS receivers would cause small degradation to the channel availability (less than 10 per cent increase in unavailability, i.e., 99% availability reduced to no lower than 98.9%.) In terms of mean time between interference events, 0.1% degradation in availability is equivalent to one 100 ms interference every 100 seconds. The cases examined in the additional analyses provided to CITEL PCC.III included: short duration LMS transmissions, base stations with higher elevation antennas, repeater operations, broader shared bandwidth, and LMS channels with varying traffic loading rates.

Co-frequency sharing between Earth-to-space links of non-GSO MSS networks and land mobile systems is facilitated if the MSS networks are frequency agile and employ dynamic channel assignment techniques to only use channels that are temporarily not in use by land mobile systems, and if the MSS networks use short duration signals with low duty cycles. (As an example, a single non-GSO MSS network, co-frequency sharing with the LMS in 20 MHz of bandwidth, would use less than 0.04% of the channel capacity available to terrestrial systems within the satellite beam). The time shared use of the channels by the non-GSO MSS network would produce a short, infrequent interference that may be acceptable to some users. However, some classes of users and some user groups take the position that any additional interference is unacceptable.

The results for the baseline analyses were based upon co-channel sharing between certain LMS and MSS systems in a bandwidth of 1.0 MHz. The results obtained may be applied to larger shared bandwidths, if the conditions of operation within the larger bandwidth are similar to those described in the baseline analysis. In such cases:

1) the probability of interference to the LMS from one non-GSO MSS system would be much less than the values calculated in the baseline analysis for a 1 MHz shared bandwidth, or alternatively, multiple non-co-channel non-GSO MSS systems could operate in the greater shared bandwidth with the same probability of interference as calculated in the baseline analysis, and

2) a sufficient number of clear channels could be found for uplinks for multiple non-GSO MSS systems.

Annex 3

Additional Analyses in Support of MSS and LMS Co-frequency Sharing

<u>Sensitivity of MSS band-scanning receivers to short duration LMS transmissions</u>
An input paper to the last WP 8D meeting (Doc. 8D/150) provided a detailed analysis of co-frequency sharing between non-GSO MSS networks and land mobile systems. Appendix A of Annex 3 of that document, "Band Scanning Receiver Sensitivity Analysis", provided information about the sensitivity of DCAAS type receivers to different duration signals. However, for brevity, that information was not preserved in the WP 8D output text from that meeting. The key results of that Appendix are reproduced below.

"The band-scanning receiver is significantly more sensitive to longer duration signals. Figure A-1 shows the in-band transmit power sensitivity for signal durations up to 0.5 seconds. The band-scanning receiver can detect a 0.5 second duration, 460 MHz, 2.5 kHz bandwidth, 3.5 mW transmit power signal anywhere in the satellite footprint with 99.9% probability. For a 16 kHz signal the sensitivity is 22 mW."

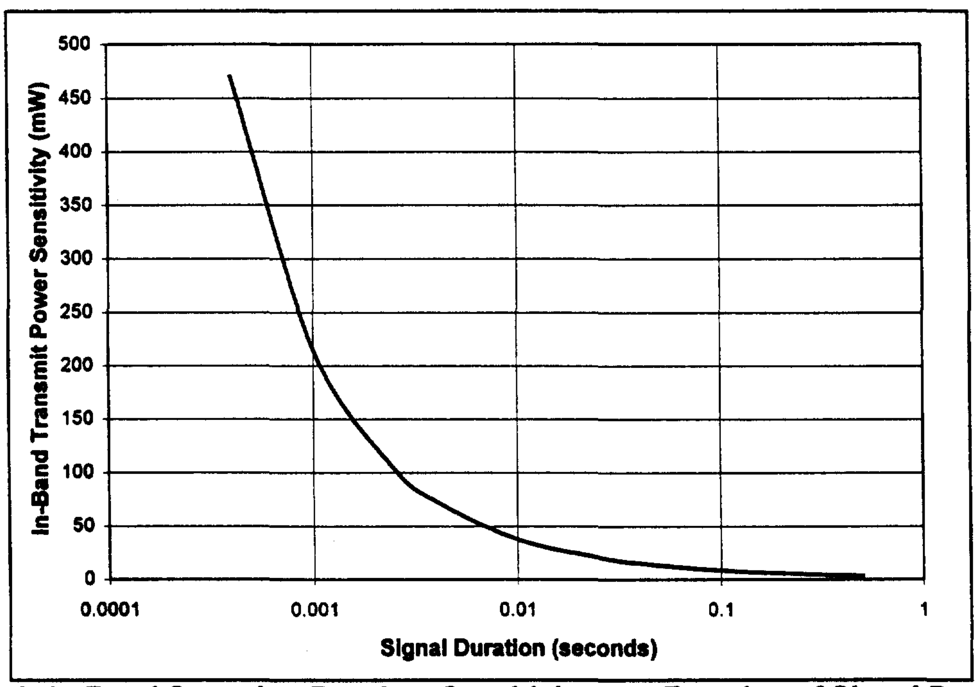

Figure A-1. Band Scanning Receiver Sensitivity as a Function of Signal Duration

By referring to Figure A-1, one may read the receiver sensitivity for signal durations shorter than 0.5 seconds. Specifically, for a 23 ms signal duration (a value cited by Israel at CPM-97 in document CPM97/80) the curve shows a sensitivity of about 30 mW for LMS transmitter power at 460 MHz. Generally, LMS transmitters greatly exceed this power level and would be very readily detectable by the MSS band scanning receiver.

Deviations from worst-case analyses used in the baseline scenario

The baseline scenario modeling incorporates several worst case-conditions which tend to produce very conservative results for the LMS environment specifically modeled. In other cases, more practical assumptions may be used to calculate average or typical results.

For modeling non-GSO MSS interference into LMS receivers, the worst-case conditions include:

1. Band scanning receiver fails to detect an active channel.
2. Full satellite beam is filled with land area containing active LMS systems.
3. Only one satellite is in view.

For modeling LMS transmitters interfering into satellite receivers of the MSS network, the worst-case conditions include:

1. Non-GSO MSS MESs transmitting at 100% of capacity 24 hours per day
2. Terrestrial LMS stations and non-GSO MSS MESs geographically clustered in the same areas
3. Satellite beam covering the whole of CONUS (most of the time the satellites will see large ocean areas and a lesser number of LMS stations in the beam because of rapid satellite motion and varying satellite ground tracks.)

When considering sharing cases other than those modeled, it may be appropriate to relax one or more of the worst-case conditions. Alternatively, additional worst-case conditions may need to be included for other cases.

Use of repeaters in land mobile networks

The basic criteria that determines the acceptability of the potential interference is the availability (as perceived by a user) for the particular channel that he is trying to use. When the user listens - if there is interference from a MES, the statistics as modeled in the baseline analysis fit the case. The fact that 5 or 10 or more other listeners are also experiencing interference from the same source does not change the availability of the signal to that particular user. When the user transmits - his channel availability for transmission is not changed by the fact that any interference that occurs may be "repeatered" to a number of receivers. The statistics are still valid for his channel. There is certainly a greater effect (in number of listeners affected) when a repeatered channel suffers interference, however the statistics on availability for any one user are unaffected by the number of other participants in the communication.

LMS channels with varying traffic loading rates

The baseline analysis results are directly scaleable to account for different traffic loading levels. Of course, if there are channels that are continuously in use, the band scanning receivers in the MSS satellites would preclude those channels from being used for MES transmissions.

ANNEX 4

Proposals for Agenda Item 1.9.1

Mobile-Satellite Services Below 1 GHZ

Introduction:

The attached U.S. proposals address issues related to mobile-satellite services (MSS) operating below 1 GHZ. WARC-92 allocated 3.45 MHZ of primary spectrum to this service. Since that time, the United States has licensed three non-geostationary MSS systems to operate in the U.S. in these new primary frequencies and has six pending system applications. Satellites from the first system have already been launched.

Experience with the use of the MSS bands below 1 GHZ, as well as recent studies of the ITU-R that are reflected in the Report of the Conference Preparatory Meeting CPM), indicate that operational and technical means are available to facilitate sharing between the non-GSO/MSS and other radiocommunication services having allocations and operating below 1 GHZ. Proposals for additional allocations for mobile-satellite services may be made pursuant to agenda item 1.9.1 and Resolution 214.

The CPM Report states that additional spectrum will be necessary to meet the rapidly developing, near-term requirements for MSS below 1 GHZ. The United States proposes to modify the international Table of Allocations to include X.Y MHZ of spectrum to be used by MSS, or associated feeder links. The bands suggested for allocation to MSS include: [401-406 MHZ (space-to-Earth) and 450-470 MHZ (Earth-to-space).

Additionally, the U.S. proposes to modify a number of footnotes to existing non-GSO/MSS allocations in the bands 137-138 MHZ (space-to-Earth) and 149.9-150.05 MHZ (Earth-to-space).

Article S5

MOD

MHZ

450 - 470

<table>
<tr><th colspan="3">Allocation to Services</th></tr>
<tr><th>Region 1</th><th>Region 2</th><th>Region 3</th></tr>
<tr><td colspan="3">450 – 455
FIXED
MOBILE
MOBILE-SATELITE (Earth-to-space)
S5.271 S5.286□</td></tr>
<tr><td>455 – 456
FIXED
MOBILE
MOBILE-SATELLITE
(Earth-to-space)
MOD S5.209 MOD S5.271A S5.286A
S5.271 S5.286B</td><td>455 – 456
FIXED
MOBILE
MOBILE-SATELLITE
(Earth-to-space)
MOD S5.209 MOD S5.271A S5.286A S5.286B S5.271</td><td>455 – 456
FIXED
MOBILE
MOBILE-SATELLITE
(Earth-to-space)
MOD S5.209 MOD S5.271A S5.286A
S5.271 S5.286B</td></tr>
<tr><td colspan="3">456 – 459
FIXED
MOBILE
MOBILE-SATELLITE
(Earth-to-space)
S5.271 S5.287 S5.288</td></tr>
<tr><td>459 – 460
FIXED
MOBILE
MOBILE-SATELLITE
(Earth-to-space)
MOD S5.209 MODS5.271A
S5.271 S5.286B</td><td>459 – 460
FIXED
MOBILE
MOBILE-SATELLITE
(Earth-to-space)
MOD S5.209 MODS5.271A S5.286A
S5.286B S5.271</td><td>459 – 460
FIXED
MOBILE
MOBILE-SATELLITE
(Earth-to-space)
MOD S5.209
MODS5.271A
S5.271 S5.286B</td></tr>
</table>

MOD

46460 – 470	FIXED MOBILE <u>MOBILE-SATELLITE (Earth-to-space)</u> Meteorological-Satellite (space-to-Earth) S5.287 S5.288 S5.289 S5.290

Reasons:

To expand allocation to world-wide to make use of global coverage features of non-GSO MSS systems. Studies have shown feasibility of sharing with fixed and mobile systems. Allocation in band as shown allows selection of different mobile satellite service channels in different parts of the world to accommodate varying intensities of use by the mobile service.

MOD S5.209

The use of the bands 137 - 138 MHZ, 148 - 149.9 MHZ, 400.15 - 401 MHZ, <u>and 450 -</u> ~~455 - 456 MHZ and 459 -~~ 470 MHZ by the mobile-satellite service and the bands 149.9 - 150.05 MHZ and 399.9 - 400.05 MHZ by the land mobile-satellite service is limited to non-geostationary satellite systems.

<u>Reasons:</u>

To extend the limitation to non-geostationary satellite systems to the band 450 - 470 MHZ.

MOD S5.271A□

The use of the bands <u>450</u> ~~455 - 456 MHZ and 459~~ - 470 MHZ by the mobile-satellite service is subject to coordination under No. **S9.11bis**.

<u>Reasons:</u>

To extend the coordination procedures to the band 450 - 470 MHZ for the non-geostationary MSS systems.